SAFEGUARDING CALIFORNIA: IMPLEMENTATION ACTION PLANS

Forestry Sector Plan

AGRICULTURAL SECTOR PLAN

BIODIVERSITY AND HABITAT SECTOR PLAN

EMERGENCY MANAGEMENT SECTOR PLAN

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Forestry Sector Plan

Introduction

Forests are our key life support system on this planet, and one that occupies a significant portion of the state: about 33 million acres of California's 100 million acres. They provide a multitude of key benefits — clean air and water, wildlife habitat, building materials, renewable energy, and recreation. Climate change in California forests is affecting tree survival and growth, forest composition, forest health and productivity, and has increased the intensity of ecosystem disturbances from wildfire, insects and spread of invasive species and land type conversion. These impacts result in less capacity to store carbon and more risk of greenhouse gas emissions.

Climate change suggests a continuing and even accelerated risk of wildfire and a trajectory of more frequent drought (Diffenbaugh et al., 2015) and higher fire severity in some portions of the state (Fried et al., 2004). Some plant communities cannot adapt fast enough to increasing drought stress, resulting in large scale mortality from insects, fire, and disease (Grant et al., 2013).

Increased fire extent, intensity, and severity can affect aquatic habitats (Bisson et al., 2003) and water quality (Ice et al., 2004). These future climate scenarios combined with continuing projections of residential growth into the wildland (Mann et al., 2014) suggest that the current wildfire-related problems are poised to become even larger and more costly in the near future. For the purposes of this chapter, climate impact discussion and adaptation strategies focus on ecosystems supporting tree cover, forests and oak woodlands.

The Forestry Sector plan categorized actions into 6 actions: 1) Forest Health; 2) Urban Forestry; 3) Biomass Utilization; 4) Watershed Health; 5) Research; 6) Monitoring.

Vulnerability Assessment

CALFIRE is in the process of updating the 2010 California's Forests and Rangelands Assessment. In 2008, the U.S. Farm Bill directed the U.S. Forest Service (under the Department of Agriculture) to coordinate with states on forest and rangelands assessments. The first coordinated report for California was completed in 2010.The process for developing the 2010 Assessment was based on looking at the location of forest and range resource assets in the context of potential threats across the state. This information

was used to determine priority landscapes that have high asset values that are likely to be threatened — this Assessment will help guide efforts to acquire and direct funding that can enable programs and other tools that create desired future landscape conditions.

There is also the Southwest Regional Climate Hub and California Subsidiary Hub Assessment of Climate Change Vulnerability and Adaptation and Mitigation Strategies (Elias et al., 2015). The report addresses climate issues related to forests and agriculture, including specialty crops.

FOREST CONDITIONS

An undisputed fact is that wildland fires burn across landscapes without regard for political jurisdictions, property lines, governing laws, or land management goals. Furthermore, with the increasing threat and prolonged impacts of four years of drought in California and expansive acres of insect and disease outbreaks, these realities have heightened the importance of implementing forest health projects for carbon sequestration and climate benefits.

Both the United States Forest Service and CAL FIRE have collected forest land spatial data exhibiting the exponential increase in insect attack, disease, and moisture-stress related tree mortality. These areas are more prone to high severity fire and the dead, decadent, and dying trees emit methane and lose carbon storage capacity. The southern Sierra Nevada Region is entering an epidemic of pine bark beetles and fir engraver beetles. Estimates in some areas are that 20 to 25 percent of the pine trees are already dead or dying.

The negative impact of GHG emission is exacerbated when landowners remove these trees to prevent disease spreading and reduce fire risk, but are then unable to convert the trees and biomass into long term-carbon storage as harvested wood products or bio-feedstock for

Wildland fires burn across landscapes without regard for political jurisdictions, property lines, governing laws, or land management goals.

electrical generation, heat energy, or other co-products (bio-char, landscape mulch, biofuel). The lack of capacity to manage the biomass and trees for a higher value use results in this wood being left in the forest, and in many cases open-pile burned. Both of these activities undermine the objectives of GHG emission reduction goals.

When managing forested landscapes for GHG benefits, CAL FIRE, Air Resources Board, and the Natural Resources Agency are concerned about the increasing emissions of short-lived climate pollutants (SLCPs) associated with the growing number, size and severity of catastrophic wildfires. SLCPs are more recently recognized climate change drivers that remain in the atmosphere for a much shorter period of time than other targeted climate pollutants, mainly carbon dioxide (CO_2); however, their potency, in terms of warming effect, is tens, hundreds, or even thousands of times greater than that of CO_2. They are responsible for about 40 percent or more of global warming experienced to date. SLCPs relevant to forests include black carbon (soot) and methane (CH_4), with about 64 percent of black carbon emissions sourced from wildfire. Given this, the amount of black carbon can be significantly reduced by reducing the frequency of catastrophic wildfires. Methane emissions can be reduced by removing the downed trees and biomass from the forest to avoid emissions from aerobic and anaerobic activity before or after a wildfire. The worst option, from a GHG emissions perspective, is a no-treatment strategy.

INCREASED TEMPERATURE AND EXTREME EVENTS

Temperature rise affects plant species behavior, including seed production, seedling establishment, growth and vigor. It also reduces moisture availability for plants, threatens seedling and plant survival, increases the risk of wildfire, and enhances the survival and spread of insects and possibly pathogens.

With warmer temperatures, certain tree species in Californiahave responded by migrating to higher altitudes. Recent research concluded that upslope movement of pine forests and oak woodland conversions to grassland have already occurred due to climate change (Thorne et al., 2006). As the rate of climate change increases some tree species may not be able to adapt to changed conditions. Species with currently restricted ranges will probably be most vulnerable, while species with broader climate tolerances may be able to adapt more easily. Alpine forests and associated plant species are particularly vulnerable, because they have little room to expand. Ecologists also no longer assume that

With warmer temperatures, tree species in California may respond by migrating both northward and to higher altitudes (Shugart et al., 2003). Recent research concluded that upslope movement of pine forests and oak woodland conversions to grassland have already occurred due to climate change (Thorne et al., 2006).

plant communities will migrate intact, so forest and range communities may change in species composition as they move.

Researchers modeled interactions of temperature, wildfire, carbon dioxide, and other climate effects. The results have predicted declines in conifer forests, oak woodlands, savanna and chaparral, but increases in hardwood forests and grasslands (Lenihan et al., 2006).

PRECIPITATION CHANGES AND EXTREME EVENTS

Climate change is affecting precipitation and hydrology, which are critical drivers in forest ecosystems, in several ways. Recent winters have been warmer, have had less precipitation and snowmelt has begun earlier (Westerling et al., 2006). According to the California Climate Tracker, the winter average minimum temperature of 2014-15 for the Sierra Nevada region was 32.1 degrees Fahrenheit, the first time this value was above water's freezing point in 120 years of record-keeping.

In addition, a greater percentage of precipitation is already falling, and will continue to fall, in the form of rain rather than snow. Less snowpack and the temporal changes in snowmelt and spring runoff can lead to longer dry periods in summer months, reducing available moisture for forest plants. Moisture deficits may, however, be somewhat offset by increases of atmospheric carbon dioxide which generally cause plants to increase their water use efficiency. Since 2009,

Healthy forests help anchor soil and absorb rain and snowmelt, so flooding and landslides are less severe.

California has experienced several of the most extreme natural events in its recorded history: severe drought, an almost non-existent Sierra Nevada winter snowpack, five of the top 20 largest forest fires in terms of acreage burned, and two years in a row of the hottest average temperatures.

Healthy forests help anchor soil and absorb rain and snowmelt, so flooding and landslides are less severe. Forests also help regulate the timing and magnitude of water runoff and water flows; and they have very significant impacts on water quality, because they provide a filtering function that prevents impurities from entering streams, lakes, and groundwater.

For the purposes of this chapter, climate impact discussion and adaptation strategies focus on ecosystems supporting tree cover, forests and oak woodlands.

FIRE HISTORY AND MANAGEMENT

Wildfires are an intrinsic part of California's forest and rangeland ecosystems. Our native habitats have evolved with and adapted to periodic wildfire disturbance. However, fire activity in California has undergone many changes over time. In the past 20 years we've experienced 14 of the 20 largest forest fires in recorded history[34]. Larger and more frequent wildfires will impact California's economy by increasing fire suppression and emergency response costs, damages to homes and structures, interagency post-fire recovery costs, and damage to timber, water supplies, recreation use and tourism. As climate change continues these costs are expected to increase. In 2015, for the first time in history, U.S. Forest Service spent over half their budget on fire suppression by the end of August.

Management options for adapting to the threat of increased fires must address public health, public safety and ecosystem protection. Fire protection measures, including suppression, prevention and building codes, can reduce the occurrence, extent and damage of wildfires. Fuel reduction by manual, mechanical and prescribed burning can reduce the size and severity of wildfires. Vegetation and wildfire management may be used to reestablish conditions that support historic or more ecologically beneficial and socially acceptable fire regimes. In significantly altered ecosystems and developed areas, this may take many steps and treatments.

Fuel loads have increased with fire suppression practices. Strategically placed, fuels reduction work involving mechanical removal and prescribe burning is the most effective means to reduce hazard and risk and help restore vegetation conditions that are more resistant to wildfire damage. The effectiveness is best seen when wildfire burns into areas where fuel treatments have taken place. As an example, the Lanes Fire, in the Fresno-Kings Unit, burned into the Beal Fuelbreak and, as a result of fuel reduction treatments the spread of the fire was slowed. This allowed resources to more efficiently take suppression action on the fire (CAL FIRE and Board of Forestry and Fire Protection State Fire Plan, 2010).

Removing biomass from the forest and using it to develop products and generate energy production as a fossil fuel alternative is another important strategy to store carbon and reduce emissions. The USDA Forest Service manages over half of all California

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[34] http://www.fire.ca.gov/communications/downloads/fact_sheets/20LACRES.pdf

forests so their land activity is significant for the overall health of the State watersheds. In 2014, the Forest Service conducted fuels treatments and forest health improvement on about 160,000 acres of their lands. Regional leadership has expressed the need to treat two to three times more acres annually to address the backlog of fuels reduction needs and forest restoration (USDA Forest Service Region 5, 2015).

Based on the area of ecosystems that historically supported frequent low-severity fire regimes, the potential need for prescribed burning or other treatments that restore fire resistant ecosystem conditions may be estimated at over a million acres per year. While prescribed burning treatments can be less expensive to conduct, in many cases reintroduction of fire is not prudent until heavy understory and ladder fuel hazards have been treated through alternative means (e.g., mechanical treatments). Additional research, monitoring and information sharing on the effectiveness of all treatments to reestablish desired conditions for supporting wildland fire will also be very important.

Forestry Adaptation Strategy

1 Improve forest health, resiliency and co-benefits by implementing forest management practices on public and private lands

- Coordinate efforts to reduce wildfire risks and severity to reduce associated emissions and avoid risk of landscape conversion to invasive species
- Manage the forest in such a way that increases overall carbon storage and provides multiple co-benefits such as water and biodiversity protection.
- Identify priority landscapes to invest resources to demonstrate greater benefits
- Better understand the tradeoffs between different climate responses to forest management actions.
- Incentivize voluntary landowner measures, such as conservation easements, in areas of high risk for conversion to more intensive uses.
- Provide funding to support, maintain, and expand seed banks and revive state tree nurseries.
- Qualitatively and quantitatively evaluate co-benefits to better understand opportunities and trade-offs
- Provide long term stable investment in forest health in order to incentivize planning and public and private investments.

2. Continue investing in urban forestry

- Expand tree canopy and vegetative cover in urban areas where appropriate to reduce heat

island effects, provide natural cooling, and realize many other benefits.

- Improve local understanding of policies, strategies and actions that optimize urban forest benefits for residents. This includes encouraging local governments to establish optimal tree canopy cover targets.
- Manage and maintain the urban forest to increase tree survivability, maximize carbon storage and provide multiple co-benefits.
- Improve and expand use of urban biomass that is removed for valid management purposes including but not limited to pests and disease.
- Maximize use of trees and vegetation as infrastructure in cities for multiple benefits such as reducing energy use, capturing storm water, and improving water and air quality.

3. Improve management practices and market conditions for biomass utilization

- Help retain current levels of biomass power generation in the state, revitalize currently idle facilities and expand facilities in strategically located regions.
- Retain current levels and expand uses of biomass for wood product development.
- Consider end use opportunities for biomass as part of forest management project design
- In the pricing, account for the societal value of bioenergy and other end uses of biomass.

4. Implement forest management for the overall health and protection of watersheds

- Manage California's forested landscapes to safeguard the state's water supply reliability and quality.
- Manage forests to reduce soil erosion and protect water quality.
- Account for the value of healthy watersheds and their ecosystem services and consider the avoided costs of investing in protecting and restoring these services.

5. Implement Priority Research Agenda

- Coordinate with key agencies, University of California and other research entities to identify and fill knowledge gaps related to climate adaptation and evaluate the most effective strategies.
- Improve methods, models and equations for estimation of carbon storage and greenhouse gas emissions.
- Research working forests and forest management actions as a means to increase forest health, increase carbon storage and mitigate climate change.
- Research fuels reduction as a means to reduce wildfire emissions and increase carbon storage.

6. Implement Forest Health Monitoring in an Adaptive Management Context

- Establish a comprehensive monitoring and adaptive management program to quantify the

effects on climate change and the effectiveness of adaptation strategies.

- Research species migration responses to climate change.
- Identify robust forest management strategies that will be successful best management practices over a wide range of plausible future climate situations.
- Investigate the feasibility of creating a cooperative network of research forests across the State, including universities, federal agencies and State agencies, to monitor climate change.

Current Actions and Next Steps

In response to the current epidemic of tree mortality, Governor Brown issued a State of Emergency on Tree Mortality Proclamation in October 2015 (insert link to gov.ca.gov/docs/10.30.15 Tree Mortality State of Emergency.pdf). It requires State agencies to identify high hazard zones for wildfire and falling trees and prioritize tree removal in these areas, and calls for several actions to enable removal of hazardous trees. It also calls for expanding the practice of prescribed burns, to reduce wildfire risk and avoid pollution from major wildfires. The Proclamation also calls for facilitating power contracts for new facilities and extending operation of existing biomass power plants that receive feedstock from high hazard zones. To implement the Proclamation, in November 2015, the Governor launched the State Tree Mortality Task Force (insert hyperlink to www.treetaskforce.org) comprising of state and local government agencies, and key stakeholders, to implement the numerous directives, including monitoring tree removal efforts to assess their effectiveness in protecting forest health and strengthen forest resilience.

The Forest Carbon Plan will provide forest carbon targets and an array of strategies to promote healthy forests that protect and enhance forest carbon and the broader range of forest environmental services for all forests in California. The vision of forest protection and enhancement includes:

- Sustainable forests that are net sinks of carbon.
- Healthy forests that are resilient to anticipated climate change effects, including volatile weather and changing precipitation regimes; increased forest insect and disease threats; and higher wildland fire risks.
- Protection of watersheds and water supplies (quality, quantity, and infrastructure).
- Forests that provide management opportunities that generate long-term economic benefits for landowners, workers, and communities.

- Working forests that produce wood products and biomass for energy and are managed to maintain forest health and biodiversity.
- Forests that are protected from fragmentation and conversion, and that provide a diversity of quality, interconnected habitat types for terrestrial and aquatic wildlife species, including listed and non-listed species.
- Forests that provide an abundance of outdoor recreational and tourism opportunities.

As part of the forest carbon plan, a Resource Economic Study will be drafted by UC Berkeley academics. The study will evaluate several different management actions and investment choices identified in the Forest Carbon Plan.

ACTION 1: FOREST HEALTH

Through CAL FIRE's new Forest Health Initiative, investments will be strategically targeted to achieve net greenhouse gas emission reductions into areas that have high rates of carbon stock, but currently face heightened wildfire risk from dead, dying, and diseased trees attacked by insects and other pathogens. Projects will be planned across large landscapes, in coordination with adjacent land owners, resulting in more efficient planning and a greater impact to forest health and carbon benefits. Where feasible, these projects will also include a biomass use component to ensure that as the volume of woody biomass removed increases, there is infrastructure to use the forest residue, thereby avoiding GHG emissions from open pile burning or natural decay. The targeted investments will also take into account rural communities in need of local economic development and job creation, and those communities where there is active support of forest management and biomass use. CAL FIRE will also make urban forestry investments prioritized toward disadvantaged communities. CAL FIRE will also continue to secure working forest conservation easements through its Forest Legacy Program, focused at reducing the increasing pressure on landowners to convert their forestlands to other uses such as housing subdivisions, rural lots and vineyards.

CAL FIRE will strategically target investments that will achieve net greenhouse gas emission reductions into areas that have high rates of carbon stock, but currently face heightened wildfire risk from dead, dying, and diseased trees attacked by insects and other pathogens.

Projects which are facilitated through special funds like cap and trade auction revenues — or the Greenhouse Gas Reduction Fund (GGRF) — cannot solely address the magnitude of the threats facing California forests as they function to help sequester carbon and offset the negative impacts of GHG emissions. However, as a partial solution, CAL FIRE will institute a process to further refine the identified high-priority landscapes to concentrate GGRF investments in areas that can reap the largest direct benefit for forest resiliency and co-benefits, such as increased carbon sequestration, improved water quality and

quantity, diversity of wildlife habitat, and rural economic stability.

GGRF Awards – Fiscal year 14 - 15 was the first year CAL FIRE administered Greenhouse Gas Reduction Funds (GGRF) for forest-related projects. A total of about $27 million was competitively awarded and distributed in the form of grants. An estimated $15 million was awarded in grants for urban forestry, about $5 million for watershed reforestation and restoration, just over $4 million for forest legacy in the form of conservation easements, $1.5 million for pest control and nearly a million for other activities.

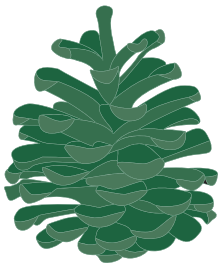
CAL FIRE's Forest Improvement Program (CFIP) will continue to work with the US Forest Service, University of California Extension, Resource Conservation Districts (RCDs), Natural Resource Conservation Service and others to prevent and minimize catastrophic wildfire and restore fire resistant conditions in fire adapted vegetation types through mechanical and prescribed fire treatments, and to assist with post-fire recovery.

Allocated funding in fiscal year 14-15 was approximately $1.5 million. CAL FIRE has been awarded over $6 million ($2.9 million in 2015 and $3.4 million in 2016) from the Timber Regulation and Forest Restoration Fund for CFIP grants.

Seedbank and Nursery Support – CAL FIRE will work with the Forest Service and private sector to improve long-term seedbanks and nurseries in order to secure genetically appropriate varieties for future plantings and to preserve genetic legacies.

The L.A. Moran Reforestation Center (LAMRC) seedbank catalogues and stores approximately 42,000 pounds of primarily native conifer seeds which are available for replanting forest stands after fires, insect or disease outbreaks, or other catastrophic events but have gone unused for seven years due to inadequate funding. LAMRC continues to collect and process conifer cones for deposit to the seed bank to both replace exhausted stocks and to increase the natural genetic library.

Adaptive approaches to forest regeneration can increase resilience in the short and long-term by adjusting silvicultural practices to establish forests that are more tolerant of future climate conditions. This includes planting genetically appropriate species that will be better adapted to changed climate conditions than the genotypes currently on site.



Approximately
42,000
POUNDS
of primarily native conifer seeds are stored and available for replanting forest stands.

The nursery facility in Magalia is currently out of use and being converted to a CCC camp. The LAMRC located in Davis could be reopened if needed.

Land Conservation – CAL FIRE is actively working to acquire approximately 13,000 acres of PG&E properties that will broaden the diverse landscapes and vegetation types on the Demonstration State Forests to better represent those found across the state and will provide new opportunities for research and

demonstration on those landscapes. Each of these acquisitions will include a conservation easement to ensure that these properties remain forestland and are not converted to other uses. Along with the existing State Forests and federal and University research forests, these new properties can form a network of climate change monitoring stations across the State.

Review Regulatory Framework 1504 – Assembly Bill 1504, 2010 requires that Board of Forestry and Fire Protection (BOF) and CAL FIRE guarantee its regulations governing commercial timber harvesting take into account the capacity of forests to sequester 5 million metric tons (MMT) of carbon/year, consistent with California's climate change mitigation goals for the forest sector established under Assembly Bill 32.

Structure Protection Exemption – In May 2015, the BOF adopted emergency regulations allowing specified forest management activities, including exempting cutting or removal of trees between 150 and 300 feet from an approved and legally permitted habitable structure for the purpose of reducing flammable materials and maintaining a fuel break. The previous exemption allowed for removal of fire hazard trees within 150 feet of a structure.

Protection of the Beneficial Uses of Water and Riparian Functions – The BOF adopted emergency water drafting regulations in August 2015. The water drafting emergency regulations affect all Forest Districts and require Registered Professional Foresters planning timber operations to consider beneficial uses of water including the potential impacts to drinking water. These emergency regulations were necessary to recognize the severity of the drought and highlight potential impacts to fisheries and wildlife as well as domestic water supplies from timber harvest related drafting operations.

The CAL FIRE PTEIR report is designed to have the combined benefit of increasing the carbon sequestration potential of California's nonindustrial timberlands, while decreasing carbon emissions from wildland fires.

AB 1492 Timber Regulation and Forest Restoration Fund

The Timber Regulation and Forest Restoration Fund (TRFRF) Program is a component of Assembly Bill 1492 (2012). The major elements of the TRFRF Program provide a funding stream via a one-percent assessment on lumber and engineered wood products sold at the retail level, seek transparency and efficiency improvements to the State's timber harvest regulation programs, provide for development of ecological performance measures, establish a forest restoration grant program, and require program reporting to the Legislature.

Program Timberland Environmental Impact Report for Carbon Sequestration and Fuel Reduction (PTEIR)

CAL FIRE has developed the PTEIR report to meet the goals of the Global Warming Solutions Act of 2006. The Program is designed

to have the combined benefit of increasing the carbon sequestration potential of California's nonindustrial timberlands, while decreasing carbon emissions from wildland fires. Over one-half of the privately owned, commercial timberland in California is owned by nonindustrial landowners. Long-term uneven aged management of these lands and the retention of large, old trees can increase the ability of timberlands to sequester carbon through increased growth and inventory and to convert carbon dioxide to oxygen through photosynthesis. Prudent timberland management can decrease the potential for large wildland fires that release greenhouse gases by creating forests that are less susceptible to ignition and that reduce the intensity of wildland fires, thereby allowing for more successful fire suppression efforts. The Program will provide grant funds for the development of PTEIRs to facilitate these declarations.

Vegetation Treatment Program Environmental Impact Report

The BOF has initiated the Vegetation Treatment Program as part of a comprehensive fire prevention strategy. This statewide program provides a framework for vegetation treatment projects that reduce fire risk through strategic fuels management on SRA lands and supports federal and local non-SRA fuel reduction projects.

State Fire Plan

The State Fire Plan provides overall statewide goals and objectives, with individual Unit Fire Plans that compliment this with the on the ground fire plan specifics. Work to begin updating the plan is just beginning and the target to complete this is 2016. The updated plan will have a stronger focus on climate change by integrating strategies to address anticipated impacts.

State Responsibility Area Program

This is a local assistance grant program for fire prevention activities designed to benefit habitable structures within state responsibility areas, including public education, that are provided by counties and other local agencies, including special districts, with state responsibility areas within their jurisdictions.

The program provides grants to a qualified nonprofit organization with a demonstrated ability to satisfactorily plan, implement, and complete a fire prevention project applicable to the state responsibility areas. The department may establish other qualifying criteria.

CAL FIRE's Urban and Community Forestry Program assists local entities with tree planting, utilizing trees and other vegetation to create infrastructure solutions, and improving urban forest management.

ACTION 2: URBAN FORESTRY

Currently funded through the Greenhouse Gas Reduction Fund, CAL FIRE's Urban and Community Forestry

Program will continue to assist local entities with tree planting, utilizing trees and other vegetation to create infrastructure solutions, and improving urban forest management. This is accomplished by providing technical assistance, education, policy consultation, and grants (CAL FIRE Urban and Community Forestry Program Strategic Plan 2013-2018). Accomplishments will help protect and expand urban forests that serve to provide cooling, carbon sequestration, protect air quality and water quality, improve public health outcomes, and habitat co-benefits.

The cross-sectoral nature of urban forestry is recognized in the California Urban Forestry Act of 1978 (PRC 4799.06-4799.12) and cannot be underestimated when it comes to climate resilience and adaptation. Some cross-sector benefits of urban forests include: In the energy sector, reductions associated with tree canopy cover via direct shading and evaporative cooling are well documented and understood. In the water sector, the ability to use trees and vegetation to capture stormwater and reduce water pollution are undeniable. This leads to less energy expended to treat stormater and pump water long distances. Urban forests provide opportunities for diverse habitat for many species or birds and animals and can provide opportunities for urban agriculture (community gardens and orchards) in the places where they are most needed. Nothing creates a sense of place in a community like a robust, healthy and diverse urban forest of trees and other plants. From a public health perspective, people are more likely to be active with adequate shade and pleasant places to recreate. In addition, people are more likely to use active transportation more when their routes are shaded. As climate change progresses, it is likely that California will warm in many, if not all, of its urban areas. Urban heat island effects will increase in extent and severity without interventions. One effective intervention is to expand urban tree canopy cover and use vegetation wherever possible as an infrastructure solution. Local governments should implement and achieve tree canopy cover goals. Public health outcomes are improved during extreme heat events with the addition of tree canopy (Preparing California for Extreme Heat: Guidance and Recommendations October, 2013. P. 12). Current research demonstrates two important trends: 1) increases in vegetation and reflectivity result in fewer heat-related deaths, and 2) urban heat islands disproportionately impact low income communities of color (*"Assessing the Health Impacts of Urban Heat Island Reduction Strategies in the Cities of Baltimore, Los Angeles, and New York." Vanos, J., L. Kalkstein, D. Sailor, K. Shickman, and S. Sheridan*, (2014). Not only are these interventions proven to be effective, but

As climate change progresses, it is likely that California will warm in many, if not all, of its urban areas. Urban heat island effects will increase in extent and severity without interventions. One effective intervention is to expand urban tree canopy cover and use vegetation wherever possible as an infrastructure solution.

they are relatively low-cost in comparison to other interventions.

Urban Forestry Carbon Protocols

These are the second iteration of the protocols, and are currently voluntary protocols through the Climate Action Reserve (CAR). The protocols include a tree planting project protocol (version 2.0) and an urban forest management protocol (version 1.0).

The first version of the urban tree planting protocol is fully adopted by ARB and can be found on their web site and the CAR website.

Urban Forestry's Role in Biomass, Carbon and Avoided Emission

The The report by UC Davis, (Bjorkman, J., J.H. Thorne, A. Hollander, N.E. Roth, R.M. Boynton, J. de Goede, Q. Xiao, K. Beardsley, G. McPherson, J.F. Quinn. March, 2015. Biomass, Carbon Sequestration and Avoided Emission: Assessing the Role of Urban Trees in California. Information Center for the Environment, University of California, Davis.), advances the scientific knowledge of carbon sequestration and avoided emissions by urban forests. Statewide tree canopy cover data by bio-region and urban land use was acquired for all urban areas of the state. In addition, transfer functions were developed using data provided by past CAL FIRE funded inventory and data projects that allow land managers in an urban setting to determine, by identifying the tree canopy cover, how much carbon is being stored and emissions avoided by their urban forest, and how much more could be stored and avoided by expansion and better management of the urban forest.

Funding Awards — During Fiscal Year 2014/15, CAL FIRE allocated $17.8 million for the Urban and Community Forestry Program ($15.7 million for local assistance grants) and received $1,062,000 in federal funding for the program. A total of 29 projects were funded with GGRF funds and were distributed throughout the state in disadvantaged communities from Yuba City in the north to National City near the border with Mexico. Additionally, 6 projects were funded with federal funds. These were projects that were educational or research oriented. Such projects cannot be funded with GGRF funds.

ACTION 3: BIOMASS UTILIZATION

The BOF and CAL FIRE will work with other agencies and the private sector as appropriate to encourage policies and strategies that help maintain utilization infrastructure (bioenergy , veneer plants, etc.), incentivize modernization of existing facilities and development of new facilities. A diversified industry infrastructure is necessary to allow different species and size of biomass to be used for its highest and best use. Co-locating biomass businesses can provide clean bioenergy power and heat to support wood products development such as fence posts, pellets, and timber.

The California Forest Biomass Working Group consists of diverse individuals and organizations committed to retaining and expanding woody

biomass infrastructure. The vision involves biomass harvesting and utilization serving as tools to accomplish collaboratively developed public land management restoration objectives based in forest ecology and focused on enhancing the resilience of forest ecosystems. Furthermore, woody biomass utilization infrastructure should be developed around rural forest communities and be focused on appropriately-scaled, diverse, and integrated facilities that sort woody materials for their highest and best use-values to make a suite of durable wood products and thermally efficient energy, optimizing returns to forest stewardship activities, businesses and communities. At the local-level, these facilities should provide a means of economic diversification and development for rural public lands communities while supporting ecological restoration, hazardous fuels reduction, and community wildfire protection.

The Statewide Wood Energy Team is a subgroup of the Forest Biomass Working Group. This group works directly with wood energy businesses and community-led wood energy projects to provide expertise, technical assistance, and small grants. The team also produces work to effectively develop the California wood energy industry.

The BioMAT Program, established by SB-1122, has inspired many communities to pursue planning and building biomass energy facilities 3 MWs or smaller in fire threat areas. The program allocates 50 MWs to forest-based bioenergy seeking to support further deployment of small scale distributed bioenergy by requiring higher prices be offered for purchase of the power. The price is established between the facility and local investor owned utility, through an auction process. The auction requires three projects be in the queue in order for the price to increase. Currently about 12 projects are in various planning stages in the Sierra Nevada and North Coast. Three of these projects are on the trajectory to be ready to participate in the auction process in the next year.

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A bioenergy facility located in North Fork, Madera County has secured the majority of the funds, through public funding sources, needed to construct the facility. This was substantially helped through a $4.9 million grant awarded by the California Energy Commission. Funding will support the construction of a 1 MW gasification facility. Since this is a new industry, a dedicated funding source to support several demonstration projects is needed. To date, project proponents have cobbled together primarily state and federal grants to fund projects. This is very challenging as each grant program has its own requirements and timelines making it challenging to keep project development moving consistently forward.

Although this program is helpful in triggering facility development, the 50 MW allocations will only serve to manage a small portion of the State's woody biomass. Furthermore, concerns

exist about specific components of the program making it difficult for the forest sector to succeed and renewable energy policies in general can be a barrier. For example, given the public safety issues associated with fire, an accelerated interconnection process for forest biomass would be very helpful, especially to secure private funds.

Fuels contracts – Although there is an abundant amount of woody biomass available as feedstock for facilities, there are variables that can make the supply uncertain. For example, projects on public lands can be delayed due to project appeals and other unanticipated actions during the project planning process. Private investors need long-term contracts to ensure a certain quality and volume of supply over a minimum of 10 years. Forest Service has multiple contracting tools that they have underutilized in Region 5 but that are necessary to build an end use for their high volume of biomass.

Thermal Heat Demonstration Projects – CAL FIRE will complete feasibility studies to consider converting boilers to wood burning in two Conservation Camp Studies to be completed by the end of 2016. The new units would replace the existing propane units however, the propane units will remain as backup. The new units will supply space and water heating and will receive biomass locally.

ACTION 4: WATERSHED HEALTH

A healthy watershed provides valuable goods and services, including but not limited to water, forest and agricultural products, hydropower energy, recreation, wildlife habitat and carbon sequestration. A comprehensive watershed evaluation was conducted on the Mokelumne Watershed, located in the central Sierra Nevada and the primary water source for the San Francisco Bay Area. Using state-of-the-art models for fire, vegetation and post-fire erosion, the potential impacts of a landscape-scale fuels treatment to modify wildfire behavior and post-fire erosion was analyzed. Financial costs and benefits of the treatments were assigned to those elements that can be valued such as homes, infrastructure, timber, biomass energy, carbon and employment.

The avoided losses in terms of both costs and lost income opportunities include the value of structures saved from wildfire and the costs of fire suppression and post-fire restoration, as well as potential revenue from carbon sequestration, merchantable timber and biomass that could be used for energy. The value of benefits ranges from $224 to $126 million and results in a benefit-cost ratio for the fuel treatments of 3 to 1, and a minimum of 2 to 1 applying the more conservative benefits value estimate (Buckley et al, 2014).

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Focusing in on the water benefits of healthy watershed, it is important to maintain existing water storage capacity to reduce the need for new

reservoirs which are costly to build and maintain. Soil loss following high severity fire negatively affects tree growth and carbon sequestration. The increasing trend in severe fires will lead to higher sediment accumulations in many Sierra reservoirs, particularly the smaller ones at middle elevations. Considerable losses in storage capacity has been documented at the Englebright Dam on the Yuba River with about one third of its storage capacity lost, and Lake Shasta with an estimated10 percent filled with sediment (Kondolf, UCB 2014), equivalent to a 400,000 acre foot loss.

ACTION 5: RESEARCH

Improve Scientific Knowledge Base – CAL FIRE programs, such as the Fire and Resource Assessment Program, will work with Scripps, UC, FOREST SERVICE, Energy Commission and others to refine climate models for CAL FIRE's Fire Protection and Resource Management Programs. CAL FIRE's Demonstration State Forest Program will also work with the FOREST SERVICE Pacific Southwest Research Station, the University of California and other landowners to establish research reserves, studies and demonstrations across geographic and elevation gradients that inform climate change forest

Boggs Mountain Demonstration State Forest – Illustrative of the challenge of improving forest health in advance to reduce wildfire risk, in 2015 the Valley Fire burned through CAL FIRE's Boggs Mountain Demonstration State Forest and left devastating impacts. This is one of eight of CAL FIRE managed demonstration state forests, sized at nearly 3,500 acres. Within the first 24 hours the fire had burned through the entire state forest. An estimated 90 percent of the trees were either killed or substantially damaged by the intensity of the fire and very little to no understory vegetation survived the fire. A plan has been developed that identifies three phases to restore the site: 1) rehabilitation/ site preparation 2) reforestation including about 500,000 seedlings and, 3) vegetation control. This effort will be monitored for experimental, research and demonstration purposes.

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Forest and Rangeland Resource Assessment – CAL FIRE is required by statute to periodically assess the condition and availability of the state's forest and rangeland natural resources. The update will expand upon the previous climate change chapter to inform the BOF's climate policy, strategic plan and climate change actions. The draft plan will be developed and is expected to be released late in 2016.

FRAP has a contract with UC Davis to model expected range shifts for a number of forest and shrub species, results expected in early 2016.

ACTION 6: MONITORING

Monitoring programs for detecting climate change, effects on vegetation and management results are needed to support adaptation planning and management. CAL FIRE will work with the California Natural Resources Agency and others to determine and implement key monitoring needs, including forest health trends, land use and management change, and effectiveness of adaptation actions.

Indicator Development – CAL FIRE developed candidate draft indicators to report on in the Forests and Rangelands Assessment, 2016. Public input has been solicited and supported through a UC Davis website (www.indicators.ucdavis.edu/forest).

Drought Monitoring – CAL FIRE is mapping dead, dying and diseased trees affected by the current drought. A Web Map Application was developed to assist Units to prioritize areas with high levels of tree mortality that need to be mapped. These areas will be submitted to the USGS National Disaster Coordinator and they will acquire current, one foot satellite imagery that can be provided to Unit staff to map dead trees.

Establish Monitoring Criteria – Establish a network of long term monitoring plots that are implemented across both longitudinal and elevation gradients to detect climate change impacts

Continue and Expand Pest Detection – Support existing programs that can provide early detection of insects, disease, and drought in forest and range lands.

Establish Adaptive Management Criteria – Identify feedback process to inform and, as necessary, adjust policy, strategies, and regulatory approaches.

Monitor Changes in Land Use – Track acres of growth and loss of forest cover as well as resulting carbon stock effects. This information is part of Forest Inventory Analysis data (FIA).

Interagency Cooperation – Collaborate with local, state and federal agencies to leverage limited monitoring resources.